

REMARKS

Claims have only been reformulated in order to conform to the requirements of U.S. practice and no new matter has been added.

The numbering of the Claims 12 to 20, which in the prior amendment were inadvertently listed as Claims 2-10, has been corrected. Claim 12 corresponds to Claim 2; Claim 13 to Claim 3 etc.

Claim 11 recites a method for secure execution of an instruction sequence of a computer application in the form of data, called typed data and comprising an identifier, said method comprising the following steps performed by an interpreter of a computer system, particularly an embedded microchip system, during the execution of a sequence of instructions of predetermined types:

- identifying a type of said typed data;
- storing the type of said typed data in a first series of given locations in a memory of said computer system;

wherein the interpreter further performs the following steps:

- generating additional data called type information elements, associated with each of said typed data and based on said identifier;
- storing or updating said type information elements in a second series of given storage locations, in order to specify the type of these typed data;
- continuously verifying, prior to the execution of each of the predetermined instructions, of the matching between a type indicated by these instructions and an expected type indicated by said type information elements stored in said second series of storage locations, so that said execution is authorized only when there is match between said types;

and wherein the second series of given storage locations corresponding one-to-one with the first series of given storage locations.

It is respectfully submitted that this claim and those dependent therefrom, clearly and patentably distinguish the cited reference. Further, said claims are clearly statutory as the step of storing on a memory of a computer system cannot be considered as the mere rerun execution of an instructions sequence.

For convenience, Applicant will present below a point-by-point response to the objections raised by the Examiner in the order that they were raised:

Paragraph 2:

The Examiner objected to Claim 20 as not limiting the subject matter further than Claim 17 on which it depends.

Claim 17 has been modified by replacing the term “smart card” by the term “microchip”. This amendment is supported by paragraph [0003] of the instant application reciting: ‘Within the context of the invention, the term "embedded System" should be understood in its most general sense. It particularly concerns all kinds of low-power terminals equipped with a microchip, and more particularly smart cards per se.’ The paragraph [0124] also supports this modification: “Finally, although the invention is particularly advantageous for embedded microchip Systems wherein the computer resources, both in terms of data processing and data storage, are limited, particularly for smart cards, it is entirely suitable, a fortiori, for more powerful Systems.”

Claim 20 thus now further limit the subject matter of Claim 17 by précising that the embedded microchip system is a smart card.

Paragraph 3:

The Examiner objected to the Claims because of their formulation. We thus replaced the expression “characterized in that” by the term “wherein” and added the expression “comprising:”. The independent claims now include a preamble, a “wherein phrase and a conclusory text setting forth those steps which Applicant considers as patentably inventive subject matter.

Paragraph 4:

The Examiner objected to the Title as not being indicative of the invention to which the claims are directed. In the previous Official Action, the Examiner suggested the following title: “Method for Implementing and Securing a Typed Data Language in an Embedded System” and Applicant proposed the following title instead: “Method and Embedded System for Implementing and Securing a Typed Data Language in a Computer System”.

The Examiner still objects this Title and states that a computer is not always an embedded system. This is true, but an embedded system as defined in the specification is always a computer system, in the general sense of a system equipped with processing means able to perform computations. The paragraph [0036] of the instant application reads as follows: “Hence, the main subject of the invention is a method for the secure execution of an instruction sequence of a computer application in the form of typed data stored in a first series of given locations in a memory of a computer System, particularly an embedded microchip System.” This paragraph contains the same wording as the Claims. It is respectfully submitted that the proposed Title is fully supported by the specification and is definitely indicative of

the invention to which the claims are directed. Reconsideration of the proposed Title is thus respectfully requested in view of the above precisions.

Paragraph 5:

The Examiner objected to Claims 11-20 as being directed to a non-statutory subject matter. The claims have been reformulated to more clearly indicate the physical “things” and the “acts” performed, for example, the step of storing or updating information elements in a second series of given storage locations.

The Examiner also states that the specification does not provide how these instructions are stored in a computer or data storage device. Applicants refer again to paragraph [0036] of the instant application, which reads as follows: “Hence, the main subject of the invention is a method for the secure execution of an instruction sequence of a computer application in the form of typed data stored in a first series of given locations in a memory of a computer System, particularly an embedded microchip System.” The specification contains many explanation of how the instructions are stored. See, for instance, the paragraph [0117] reciting: “Any application, for example downloaded via the Internet RI and written in “Java” language, is compiled by the compiler 9 and loaded via a smart card reader 70 into the memory circuits 1 of the smart card 8.” There is little doubt that one skilled I the art would have little problem in storing instructions in a computer or data storage device.

Paragraph 6:

The Examiner objected to Claims 11-20 as being narrative and indefinite. Applicant has rewritten the claims and added line indentations indicating the steps of the method. The claims have also been reformatted to help their understanding.

Paragraph 7:

The Examiner objected to the expression “the secure execution” in Claims 11 and 17 because of insufficient antecedent basis. Applicant has withdrawn the term “the” so that the introduction of the claim reads “Method for secure execution of...”.

Paragraphs 8 to 10:

The Examiner states that Schwabe anticipates the present invention under 35 USC 102. Applicant respectfully disagrees.

Actually, the patent of Schwabe aims at preventing the need for the present invention, as recited on column 4, lines 52-62 or on column 14, lines 15-20 of Schwabe. Indeed, Schwabe’s invention consists of a verification prior to the execution of an application (i.e. a sequence of instructions) and not during the execution of the application (at each step before executing each instruction in the sequence, as in the present invention). Thanks to this “pre-execution verification”, the process disclosed by Schwabe allows that the “stack monitoring for overflows” is not necessary anymore. This clearly means that the invention of Schwabe will not use a stack monitoring as used in the present invention comprising the classical monitoring of operand stacks (first series of storage location) and the new and inventive monitoring of a second stack (second series of storage location) containing the information related to the identified types of data of a sequence of instructions. The invention of Schwabe uses only one stack for the verification since it verifies the sequence of instructions all at once, prior the execution of this sequence. Thus, Schwabe does not and cannot anticipate the step of storing or updating information elements in a second series of given storage locations.

Furthermore, Schwabe teaches a resources-constrained device which can be a smart card, but the system of Schwabe requires a remote verification of the application prior its loading into the memory of this smart card (column 18, lines 22-28 and lines 53-60 of Schwabe). This clearly means that the verifier of Schwabe cannot be implemented in an embedded microchip system such as a smart card contrary to the present invention.

Schwabe teaches that when the verification of a sequence of instructions is coupled with the execution of this sequence of instructions, the verification is performed prior the execution of the whole sequence, not during the execution of the sequence as a whole and prior to the execution of each instructions of the sequence. It is important to understand the difference between a verification of the whole sequence of instructions (i.e. of the whole application, for instance) prior its execution and a verification of each instructions prior to their execution, during the execution of the sequence.

In the paragraphs column 14, line 58 to column 15, line 45 of Schwabe's description cited by the examiner, it is explained that the verifier of Schwabe creates a single virtual stack which is compared directly to the binary file (which can also be an API definition file as recited in column 16) for checking matching of expected types of each instruction prior the execution of the binary file, until the process reaches the last instruction. This clearly means that the verifier does not examines the instructions during the execution of the sequence of instructions but instead verifies the binary files entirely before it can be executed.

Schwabe does not teach or suggest an the interpreter performing the following steps, **during the execution of a sequence of instructions of predetermined types:**

- generating additional data called type information elements, associated with each of said typed data and based on said identifier;
- storing or updating said type information elements in a **second series of given storage locations**, in order to specify the type of these typed data;
- continuously verifying, **prior to the execution of each of the predetermined instructions**, of the matching between a type indicated by these instructions and an expected type indicated by said type information elements stored in said second series of storage locations, so that said execution is authorized only when there is match between said types;

and wherein the **second series of given storage locations corresponding one-to-one with the first series of given storage locations**.

In bold and underlined above are the particular features that are not found in Schwabe's invention and that are specific to the present invention. Schwabe thus does not anticipate the present invention as claimed in Claims 11 and 17. In a rejection under 35 USC 102 the claimed invention must be identically disclosed, and the prior art patent alleged to anticipate must teach in a single structural combination all elements of the invention which perform substantially the same work in the same way. Simmonds Precision Products, Inc. v. United States, 153 USPQ 465 (CCL 1967)

Claims 11 and 17 are thus patentably distinguishable from Schwabe.

Paragraph 11 to 16:

Independent Claims 11 and 17 being patentably distinguishable from Schwabe, the dependent Claims 12-16 and 18-20 are thus also patentably

distinguishable from Schwabe, at least in their combination with one of these independent claims.

In particular, referring to paragraph 11 of the Office Action, the virtual stack of Schwabe does not correspond one-to-one with the stack monitored during the execution of the sequence of instructions since they are not generated at the same time and the virtual stack of Schwabe will contain all the type of all the instructions whereas the stack monitored during the execution will be updated for each instruction and usually not contain the operands of all the instructions as set forth in Claims 11, 13 and 17.

Referring to paragraph 12 of the Office Action, Schwabe does not teach to use a second series of storage locations (i.e. second stack) as set forth in Claims 11 and 17, and only teaches to use a single virtual stack.

Referring to paragraph 13 of the Office Action, the paragraph of Schwabe cited by the examiner does not contain any reference to a replacement of the instruction by pre-programmed security measures because the verification is done before the execution and an incorrect instruction does not have to be replaced by another instruction to be executed. In contrast, Schwabe teaches to generate a program error that may prevent the execution of the sequence of instructions.

Referring to paragraph 14 of the Office Action, Schwabe teaches the use of a smart card, but it requires a remotely pre-verified sequence of instruction contrary to the present invention.

Referring to paragraph 15 of the Office Action, the paragraph of Schwabe cited by the Examiner does not contain any reference to additional information elements that determine the size of the storage location.

Referring to paragraph 16 of the Office Action, the paragraph of Schwabe cited by the Examiner does not contain any reference to the indication of the necessity for saving or erasing an instruction by a flag and the word "flag" in Schwabe has a completely different signification.

Conclusion:

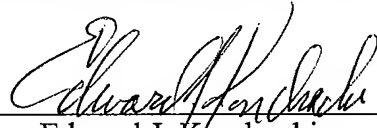
In that the cited reference fails to teach or suggest each and every feature of the claims, Applicant respectfully submits that the claims submitted herewith are patentably distinguishable therefrom. A prompt Notice of Allowance is respectfully requested.

Should the Examiner believe that any further action is necessary to place this application in better form for allowance, the Examiner is invited to contact Applicants' representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to Deposit Account No. 50-1165 (T2146-907703) any fees under 37 C.F.R. §§ 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby requested.

Respectfully submitted,

MILES & STOCKBRIDGE P.C.

By: 
Edward J. Kondracki
Reg. No. 20,604

1751 Pinnacle Drive, Suite 500
McLean, Virginia 22102-3833
Telephone: (703) 610-8627
#9307500v1